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FLEATING PAPER AND METHOD

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Fig. 1

Fig. 2

Fig. 3

Fig. 4

Fig. 5

Fig. 6

Fig. 7

Fig. 8

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PLEATING PAPER AND METHOD

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This invention relates to pleated material and more particularly to the permanent pleating of cloth formed of natural fibers, synthetic fibers, or combinations thereof. Specifically, the invention is directed to an improved pleating paper and method of pleating which results in a more uniformly pleated product and one which may be more readily handled during subsequent cutting operations.

In accordance with current commercial practice, textile materials are pleated by several methods all of which involve the use of pleating paper which is associated with the textile material to be pleated, the pleating paper forming a carrier for the textile material as it is folded or gathered into the desired pleated configuration. One of the more widely used methods employs two sheets of lightweight Kraft paper between which the textile material is sandwiched, the composite web so formed being fed into a device which gathers or folds the paper and material into pleats which are compacted one against the other. The compacted pleats are immediately fed between a pair of pressing rollers which serve to crease the paper layers and also impart a pleated configuration to the textile material. In order to hold the pleats in compacted and creased condition after they have been formed in the manner just described, pressure sensitive tape is fed through the rollers, normally a strip on each edge of the web and one or more strips in the middle, the tape serving to bind the compacted and creased assembly together for subsequent heat treatment to permanently set the pleats. In some instances the textile material is fed to the pleating device with the pleating paper only on one side of the cloth, and in such instances the pressure sensitive tape, to hold the compacted pleats during subsequent handling, is usually applied only to marginal edge portions of the pleating paper, the pleating paper being wider than the material by several inches so as to permit the tape to be applied beyond the edges of the cloth.

Pleasing by any of the methods described above often results in considerable waste of textile material in that the added thickness of the pressure sensitive tape may result in an embossing or changing of the surface characteristics of the material, that is, a change in sheen due to the additional pressure on the cloth where it is subjected to the pressure of the pressing rollers with the additional tape thickness. The resultant imperfections in the finished product may render it wholly unsuitable for its intended use. Another major disadvantage of current methods of pleating is found in the cutting room where the pleated material is to be cut into pattern. The material is cut while held in gathered or compacted condition by the tapes, and as the pattern is cut the tapes or portions thereof are severed and hence the dimensional stability of the material is lost and it loses its intended pattern shape. Similarly, the severing of the tapes and the resulting expansion of the compacted pleats may cause that material to separate from the paper carrier, which also results in a considerable waste of cloth.

In accordance with our invention, the above enumerated difficulties are overcome by providing a pleating paper the outer or exposed surface of which, i.e., the surface away from the textile material, is provided with a surface coating of a substance which will permit the pleating paper to be adhered to itself. Thus, as the pleats are formed and the paper passed through the pressing rollers, the juxtaposed surfaces of the pleats will be firmly secured together, thereby eliminating the need for tapes or other external means to retain the assembly of paper and cloth in pleated condition—and this is true irrespective of the type of pleating operation, whether it be side pleating, accordion pleating, box pleating or otherwise.

Preferably the coating substance will comprise a cohesive material, composed essentially of natural rubber latex without vulcanizing or curing agents. A natural rubber latex coating will not stick to other materials but only to itself as a face-to-face seal. Consequently, no difficulty is encountered in using a cohesive coated pleating paper either in the pleating device or during subsequent cutting of patterns from the pleated material. Instead of employing a cohesive substance to secure the paper pleats together, we have also found that the outer surface of the paper may be treated with a thermoplastic adhesive which can be reactivated by heated pressing rollers to the extent that the juxtaposed pleats will be adhered together. In either event, the coated surface of the pleating paper is such that its contacting surfaces will be adhered together throughout the entire width of the paper web, thereby imparting perfect dimensional stability and handling qualities to the textile material. Consequently, no matter if the shape of the pattern nor how small the individual cutting, the paper will not lose control of the fabric until such time as it is separated therefrom by a stripping operation.

It is therefore a principal object of our invention to provide an improved pleating paper having the outer surface thereof coated with a substance which will permit the pleats in the paper to be secured together.

A further object of our invention is the provision of an improved method of pleating which eliminates the necessity for taping together the pleats as they are formed.

These objects and other objects will appear hereinafter or which will be apparent to the skilled artisan, will appear hereinafter or which will be apparent to the skilled artisan, and which are described below and by the accompanying drawings in which:

Figure 1 is an enlarged vertical sectional view illustrating the formation of an accordion pleat in accordance with our invention.

Figure 2 is a vertical sectional view similar to Figure 1 illustrating the formation of a side pleat.

Figure 3 is also a vertical sectional view illustrating the formation of a box pleat.

Figure 4 is a vertical sectional view similar to Figure 1 illustrating a pleating operation employing two sheets of pleating paper.

Figure 5 is a diagrammatical side elevation illustrating the operation of one form of pleating device.

Figure 6 is a schematic diagram illustrating yet another type of pleating operation.

Figure 7 is also a schematic view illustrating yet another type of pleating operation.

Figure 8 is a diagrammatical view illustrating a pleating operation.

Referring first to Figure 8 of the drawings, we have therein diagrammatically illustrated a pleating operation wherein a web of cloth 1 is fed from a supply roll 2 into a pleating device 3. A web of pleating paper 4 fed...
from a supply roll 5 is juxtaposed to the under surface of the cloth as the cloth approaches the pleating device. In the pleating device the cloth and paper webs are concurrently gathered and compacted in the desired pleated configuration and passed through the nip of pressing rollers, whereupon the pressed pleats are subjected to a heating operation, as by means of a heater 6, which serves to permanently set the pleats. Subsequent to the setting of the pleats, the pleated cloth and its paper carrier will be wound into rolls, such as the roll 7, for storage or shipment.

It is to be understood that the type of pleating operation involved does not constitute a limitation of our invention; and any of the currently available pleating devices may be employed without departing from the spirit of our invention. For example, in figure 5 we have diagrammatically illustrated a pleating operation wherein the web of cloth 1 and the web of pleating paper 4 are fed into a device comprising pleating rollers 8 and 9, preferably formed of resilient material such as hard rubber and spaced so as to allow a slight clearance therebetween. A weighted pleating roller 10, preferably formed of steel and having a hard smooth surface, is positioned between and between the rollers 8 and 9 so that it rests upon and forms a pair of bites with rollers 8 and 9. Means are provided to drive pleating rollers 8 and 9 in the same direction but at relatively different peripheral speeds. To this end the roller 8 may be provided with a gear 11 adapted to mesh with a gear 12 driving the roller 9. As will be noted from the drawings, gear 11 has a smaller diameter than gear 12, so that when the gears are driven roller 8 will be driven at a faster speed than roller 9. In operation, the webs 1 and 4 will be juxtaposed and led horizontally over and under the pleating weighted pleating roller 10. The frictional contact between the weighted roller 10, the composite webs 1, 4 and pleating roller 8 is sufficient to cause the weighted roller to be rotated counter-clockwise, i.e., in the direction of the arrow in figure 5, thereby causing the composite web 1, 4 to be advanced. Due to the fact that roller 8 is rotating at a faster speed than is roller 9, a form of back pressure is set up, causing the composite web to form a transverse U-shaped loop in the area between the rollers.

As the rollers 8, 9 and 10 continue to rotate, the leading edge 14 of the loop is pushed into the bite between rollers 9 and 10. It will be understood that due to the difference in speed between rollers 8 and 9, and to the fact that the weighted roller 10 is driven through the frictional contact between rollers 10 and 8, roller 10 will have a peripheral velocity greater than that of roller 9. The roller 10, having a smooth, hard surface will, therefore, slip with respect to the composite web, the web being carried forward on roller 9 without slippage therewith, since the coefficient of friction between the composite web and the rubber surface of roller 9 is greater than between the web and the smooth hard surface of roller 10. The slippage, in conjunction with the weight of roller 10, will cause the leading edge 14 to be sharply creased as it passes through the bite between rollers 10 and 9. The trailing edge of the loop will then be pulled through the bite and creased in a similar fashion. As the pleating webs pass beyond the roller 9, they may be passed between heated platen members 15 and 16 which will serve to set the pleats, whereupon the pleated webs may be collected on supply roll 7.

In figure 6 we have illustrated another form of pleating device wherein the web of fabric 1 is fed between webs of pleating paper 4 and 4r, the cloth being sandwiched between the two webs of pleating paper. The three webs are suitably brought into superposed relationship between a pair of guide rollers 17 and 18 from which the three ply assembly is directed toward a pair of superposed rollers 19 and 20, the rollers operating intermittently in the direction of the arrows. A short distance in advance of the rollers 19 and 20, a pair of reciprocating knives or blades 21 and 22 are provided. As these blades reciprocate, they are automatically closed to grip the three plies between them and they are then advanced toward the rollers 19 and 20 to form a loop of material immediately in advance of the nip of the rollers. As the rollers are then rotated by a slight degree, they grasp and advance the loop portion between them, and at the same time the knives 21 and 22 open to release the loop and travel rearwardly to again engage the assembly to form the next succeeding loop. Upon passage between the rollers 19 and 20, the pleated material may be guided, as by means of a belt 23, between a pair of heated rollers 24 and 25 and again wound into a storage roll 7.

Figure 7 illustrates yet another mode of pleat formation wherein the cloth web 1 and paper webs 4 and 4r are fed toward a stationary drum 24 beneath a flexible steel band or series of bands 25, extending across and spaced from the drum 24 in substantially the manner illustrated. The band or bands have an opening therein through which a pleating knife 26 extends, the pleating knife reciprocating manner to contact the material and pleat it during the downstroke, the pleated material being gathered into compacted folds and moved downwardly between the drum 24 and band 25. As before, heating elements 27 may be employed to set the pleats. It will be understood that diverse other types of pleating devices may be employed to effect any desired type of pleat.

In figure 1 we have illustrated our invention as it applies to an accordion pleat or fold wherein the legs of the pleats are of equal depth. As illustrated therein the web of cloth 28 is superposed to a web of pleating paper 29 formed in accordance with our invention, the paper web 29 having a coating 30 of a cohesive substance on its outer surface thereof, i.e., on the surface away from the cloth. As the individual pleats are formed as by folding and reversely folding the superposed webs, the pleating paper will be folded upon itself and, by reason of the cohesive coating, will stick together to form double thickness, cloth retaining folds 31. As will be evident from the drawing, the adjacent folds will be compacted together in side-by-side relation, as illustrated by the area 32. Subsequent to the cutting of the pleating paper into the desired pattern, the pleating paper and cloth may be readily separated in the manner illustrated in the right-hand portion of figure 1, the contacting areas of the pleating paper, such as the opposed areas 33 and 34, being stripped apart, thereby permitting the opposing areas 35 and 36 to be readily removed. It will be evident, however, that until positive force is applied to separate the folds of pleating paper, the cloth will be securely engaged by the folds and retained in compacted condition. In actual practice, the opposed areas, such as the areas 33 and 34, need not be completely separated in the manner illustrated but rather may be simply expanded or flexed by an amount sufficient to permit the cloth pleats to be removed from between the paper pleats. A cohesive coating is ideally suited for this purpose in that it will give or stretch under tension.

The pleating paper itself may be of any basis weight adaptable to the pleating operation to be performed and the character and texture of the cloth being pleated. We prefer, however, to utilize a paper in the range of 15 to 30 pounds per 3,000 square feet of area. Bleached or unbleached chemical wood fiber papers ranging all the way from tissue weights to heavy card stock have been found to be suitable, and the heavier weight may even be composed of rope stock, although the type or texture of the paper itself does not constitute a limitation on our invention.

The amount of cohesive coating substance applied to the paper web will vary with the type of coating employed; but in every instance it must be in an amount
sufficient to result in a strong face-to-face seal between superposed areas when fed through any of the standard pleating machines. We have found that the necessary sealing is obtained with cohesive coatings in an amount from 1/4 to 6 pounds per 300 square feet of superposed area covered. To this end we have found Palsay's Cohesive B-1070, National Adhesive's Resyn 35-619 and B. F. Goodrich's 60-X-333 to be highly satisfactory. All of these materials are composed essentially of natural rubber latex without vulcanizing or curing agents. They do not contain any material that would impair a face-to-face seal, mere pressure being sufficient to effect a seal between contacting surfaces, and they will seal at room temperatures through a range in excess of 400° F. Natural rubber latex coatings of this character will not adhere to other materials but will adhere only in face-to-face relationship. This is highly advantageous in that the coated surface of the pleating paper will not adhere to the pleating rollers or to the cloth when wound into rolls or stacked.

It has also been found that the heat treatment of the pleated webs to set the pleats does not adversely affect the cohesive coatings. The pleats may be permanently set at a temperature of 380 to 400° F.; and we have found that the cohesive materials referred to hereinbefore will function satisfactorily in this temperature range. However, other temperatures may be employed and this coating is so formulated to function at and various temperatures as may be desired for any particular pleating operation.

We have also found heat seal coatings to perform very satisfactorily. These coatings may be formulated from any of the thermoplastic resins, such as polyvinyl chlorides and acetates or copolymers, nitrocellulose and other cellulose derivatives. A preferred coating, which will give excellent heat seal-to itself and will not contaminate the pleating rollers or stick to the adjacent textile layer during re-rolling or subsequent handling, is composed of a vinyl chloride resin, such as Geon 121 made by the B. F. Goodrich Company; a secondary plasticizer commonly known in the trade as HB-40, manufactured by Monsanto Chemical Company, which is a hydrogenated mixture of isomeric terphenyls; a preservative, such as diocyl phthalate, and a suitable heat and light stabilizer, such as the epoxy type, commonly known in the trade as A-5, which is a 100% epoxy resin of medium viscosity sold by the Carbide and Carbon Chemical Company. A preferred formulation of these materials is as follows:

| Parts by weight |
|-----------------|------------------|
| Geo 121         | 100              |
| HB-40 plasticizer | 20             |
| DOP plasticizer     | 40             |
| Stabilizer A-5         | 5               |

These materials are combined as a plastisol dispersion with any of the common hydrocarbons used for this purpose, such as high flash naphtha, xylol, or methyl iso-butyl ketone. These diluents may be added to obtain the desired viscosity which we have found to fall within a range between 5 to 25% hydrocarbon based on the total weight of the above ingredients.

Where a heat seal coating is employed, it will be understood that suitable heating means, either in advance of the pressing rollers or formed as a part thereof, will be provided to activate the heat seal coating sufficiently to provide a bond between the contacting surfaces thereof.

The heat which is applied to the pleating paper, either as an incident to the setting of the pleats or to re-activate the heat seal coating, is retained by the coated material for a longer time than it would be by plain, uncoated pleating paper, with the result that a coated paper improves in the quality of the pleats being formed.

Referring to Figure 2 of the drawings, we have there-in illustrated our invention as it applies to a side-pleating operation wherein the cloth 36 and the paper web 37 having an external coating 38, are formed into overlapping folds 39 with the paper folds secured together through their overlapped areas. Figure 5, on the other hand, illustrates the formation of a box pleat wherein the cloth 40 and superposed web 41 of pleating paper having a surface coating 42 are folded into box pleat formation, with each paper pleat having a pair of oppositely directed folded portions 43 and 44 which are secured together to hold the cloth 40 in position. In Figure 4 we have illustrated a pleating operation wherein the web of cloth 45 is sandwiched between two plies or webs of pleating paper 46 and 47 each of which carries a coating substance 48 on its outer surface. With this arrangement, the pleated assembly will have interdigitated folds, such as the folds 49 and 50, formed respectively by the webs 47 and 46. It may be pointed out that where only one web of pleating paper is employed, it may be used on the uppermost side of the textile material, as well as on the under side. In either event, the coated surface of the pleating paper will be outermost.

While, generally speaking, a continuous all-over coating of cohesive or heat sealed material will be employed, we have found that a discontinuous coating may also be employed. Thus the coating may be in the form of stripes extending either lengthwise or diagonally of the pleating paper, or the coating may be in the form of a printed pattern of such character that upon pleating of the web substantial areas of the pattern will be brought together in face-to-face contact. Consequently, the term "coating" as employed herein will be understood to contemplate both continuous and discontinuous coated surfaces.

In an exemplary embodiment of a discontinuous surface, such surface may be in the form of one inch stripes, disposed either longitudinally or diagonally of the pleating paper, with a one inch spacing between adjacent stripes.

Modifications, of course, may be made in our invention without departing from the spirit of it. Having, however, described our invention in certain exemplary embodiments, what we desire to secure and protect by Letters Patent is:

1. A method of pleating material which comprises the steps of feeding a length of fabric to be pleated toward a pleating member and juxtaposing to at least one surface thereof a length of pleating paper to form a composite web, said pleating paper having a surface thereof coated with a substance capable of sealing itself in a face-to-face bond, said pleating paper being juxtaposed to said fabric with the said coated surface away from the fabric, pleating said composite web by forming recurrent folds therein so as to bring adjacent areas of the coated surface of said pleating paper into face-to-face contacting relationship and sealing together the contacting areas of the pleating paper to form a compacted pleated structure in which the fabric is retained in the folds of the pleated paper.

2. A method of pleating material which comprises the steps of feeding a length of fabric to be pleated toward a pleating member and juxtaposing to at least one surface thereof a length of pleating paper to form a composite web, said pleating paper having a surface thereof coated with a cohesive substance capable of sealing itself in a face-to-face bond, said pleating paper being juxtaposed to said fabric with the said cohesive coating away from said fabric, pleating the said composite web by forming recurrent folds therein so as to bring adjacent areas of said cohesive coating into face-to-face contacting relationship and applying pressure to the pleated web so as to cause the pleats and seal together the contacting areas of the cohesive coating to form a compacted pleated structure in which the fabric is retained in the folds of the pleated paper.
3. The method claimed in claim 2 including the step of applying heat to the compacted and pleated structure to set the pleats in the fabric.

4. The method claimed in claim 3 wherein the heating step is carried out at a temperature of approximately 380–400° F.

5. A method of pleating material which comprises the steps of feeding a length of fabric to be pleated toward a pleating member and juxtaposing to at least one surface thereof a length of pleating paper to form a composite web, said pleating paper having a surface thereof coated with a heat seal coating, said pleating paper being juxtaposed to said fabric with the said heat seal coating away from said fabric, pleating said composite web by forming recurrent folds therein so as to bring adjacent areas of said heat seal coating into face-to-face contacting relationship and applying heat to said composite web in an amount sufficient to reactivate said heat seal coating, and sealing together the contacting areas of the reactivated coating to form a compacted pleated structure in which the fabric is retained in the folds of the pleated paper.

6. The method claimed in claim 5 including the step of pressing the folds in the composite web to form creases therein.

7. A method of pleating material which comprises the steps of feeding a length of fabric to be pleated toward a pleating member and juxtaposing to both surfaces thereof lengths of pleating paper to form a composite web, said lengths of pleating paper each having a surface thereof coated with a substance capable of sealing to itself in a face-to-face bond, said lengths of pleating paper being juxtaposed to said fabric with their coated surfaces away from said fabric, pleating the said composite web by forming recurrent folds therein so as to bring adjacent areas of the coated surface of each length of pleating paper into face-to-face contacting relationship and sealing together the said contacting areas to form a compacted and pleated structure in which the fabric is retained in the folds of the pleated paper.

8. In a method of pleating fabric wherein a web of pleating paper is superposed to at least one surface of the fabric and concurrently pleated therewith, the steps which comprise providing a pleating paper having one surface thereof coated with a substance capable of being sealed to itself in a face-to-face bond, and superposing the said pleating paper to said fabric with the coated surface thereof facing away from the fabric, whereby upon the concurrent pleating of the fabric and pleating paper adjacent areas of the said coated surface will be brought together in face-to-face relationship and sealed together to form a compacted structure in which the pleated fabric is nested in the paper pleats.

9. The method claimed in claim 8 wherein said coating substance is composed essentially of natural rubber latex without vulcanizing or curing agents.

10. The method claimed in claim 8 wherein the coating substance comprises a thermoplastic resin.

11. As an article of manufacture, a pleated structure from which patterns of pleated fabric may be cut, said pleated structure consisting of a length of fabric and a length of pleating paper superposed to at least one surface of said fabric, said pleating paper having a surface thereof coated with a substance capable of sealing to itself in a face-to-face bond, the coated surface of the pleating paper being positioned outermost, said fabric and pleating paper being in pleated condition with the adjoining outer surfaces of the paper pleats sealed together by means of the said coating thereon, thereby forming a compacted structure in which the fabric is tightly held within the paper pleats.

12. A composite pleated structure which consists of a web of fabric and a web of pleating paper in superposed relation, the outer surface of said pleating paper being coated with a substance capable of being bonded to itself in a face-to-face seal, said composite structure being in pleated condition in a series of creased folds with the coated outer surfaces of adjoining paper pleats bonded together in face-to-face relation to form a compacted structure.

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